0 Here is a construction axiom for what.

1, what + what, what × what: what

(a)[9] Use recursive construction to find the first four elements.
(b)[3] What is the smallest bunch satisfying the construction axiom? (No proof required.)

1 You are given natural variable \( n \) and the equation
\[
P = \begin{cases} 
  \text{if } n+1 & \text{then } n := \text{div } n \ 2. \ P \text{ else ok fi} 
\end{cases}
\]
where \( \text{div } n 2 \) is \( n \) divided by 2 and rounded down.

(a)[15] Find the first three specifications produced by recursive construction (no time variable).
(b)[6] What is the weakest specification \( P \) satisfying the equation? (No proof required.)
\[
n \geq 1 \Rightarrow n' = 1
\]

2 Let \( n \) be a natural constant. Let \( S: \text{n*nat} \) be an implementer's variable. It is being reimplemented by \( R: \text{n*nat} \) representing the same \( n \) naturals but in the reverse order.

(a)[3] What is the data transformer?
(b)[3] A user has variable \( i: \text{nat} \) and the operation
\[
\text{get } = i := S_i
\]
How does your transformer from part (a) apply to \( \text{get} \)? (Just show the formula for transforming this operation with this transformer. You do not need to calculate the resulting operation.)
(c)[3] What is the final result of transforming the operation? (No proof required.)

end of test